

## Discussion

There have been only three prior national-level studies that examined the effect of participation in WIC on the nutrient intake of children. While they generally found a positive relationship between WIC participation and nutrient intake, results of the individual studies differed by the significance of various nutrients. The first of these studies, the National WIC Evaluation, was based on data collected during 1983 (Rush 1986). Using linear multiple regression to control for observable differences across the groups, the study found that WIC children had greater mean intake of iron, vitamin C, and vitamin B-6 than did similar children not on WIC (folate and zinc intakes were not examined).

The most in-depth study of WIC's impact on the nutrient intake of children, based on data from the 1985 CSFII, was conducted by Fraker et al. (1990). Using an ordinary least squares regression model, they found that WIC had positive and significant effects on protein and vitamin C intakes (folate and vitamin B-6 intakes were not examined). They also used a bivariate selection model to control for self-selection bias and found that WIC had consistently positive, but statistically insignificant, effects on the nutrient intake of children. They hypothesized that the lack of statistically significant results may have been due to small sample size.

Rose et al. (1998), using a multivariate analysis of data from the 1989-91 CSFII, found that participation in the WIC program was positively associated with a significant increase in the intake of iron and protein (the other WIC-targeted nutrients were statistically insignificant). WIC was also associated with significant increases in intake for all three nutrients recommended as WIC-targeted nutrients. Using a two-stage regression model to control for self-selection bias, the authors found no evidence of selection bias; results from this analysis were not reported, however. A further limitation of this study is that it was restricted to children residing in households that were eligible for the Food Stamp Program; that is, households with monthly income less than 130 percent of poverty and with cash assets less than \$2,000. However, the income-eligibility cut-off for WIC is less than 185 percent of poverty and there is no asset test. Therefore, some WIC income-eligible households were excluded from their analysis.

All three of these prior analyses were based on data collected before the dramatic expansion of the child

component of the WIC program during the 1990's. Therefore, the results of these studies may not be applicable to the current situation. This study is based on data collected during 1994-96, the tail end of the program's expansionary period.<sup>30</sup> Thus, the data are more comparable to the current situation in which WIC benefits are more widely available to children.

Both Fraker et al. and Rose et al., using earlier versions of the CSFII, attempted to control for possible self-selection bias statistically by using selection bias models. However, as Fraker et al. (1990) states, the lack of identification variables in data sets such as the CSFII that can serve as identifiers in models designed to estimate WIC program effects while controlling for selection bias is problematic. That is, there is no variable in the CSFII that adequately proxies for nutritional awareness or motivation.

This study addresses the issue of self-selection bias by analyzing a subsample of children in the CSFII—those living in a household in which a woman or infant is participating in WIC—thus controlling for nutritional awareness and motivation. However, another limitation of this study (as well as the earlier studies), possible bias from rationing, was not addressed. Rationing bias may occur when the data do not allow for a determination of nutrition risk, one of the criteria for eligibility in WIC. As a result, estimates of WIC's effect generated by the regression analysis may be subject to possible bias due to the effect of rationing in which only children demonstrating nutritional risk can participate in the program while non-WIC children are less likely to have a risk. The degree to which rationing biases the results is unknown. However, the expansion of the WIC program in recent years has allowed a larger proportion of lower risk children to participate in the program. Thus, the results of this study might be less subject to bias against the program due to rationing than the earlier studies that included a greater proportion of high-risk children in the WIC program.

After controlling for self-selection bias by limiting the analysis to children living in a household with an infant or woman on WIC, participation in WIC was found to have a positive and significant ( $P < .05$ ) effect

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<sup>30</sup>The number of children participating in WIC in fiscal 1998 was only 1 percent more than in fiscal 1996 (USDA 1998b and USDA 1998d).

on the consumption of iron, folate, and vitamin B-6. The findings regarding iron and vitamin B-6 are especially important since a large percentage of children, regardless of WIC status, failed to meet their RDA for these nutrients.<sup>31</sup> Low intake of iron, which may lead to anemia, is considered to be a current public health issue, while low intake of vitamin B-6, which is associated with neurologic abnormalities, dermatitis, impaired immune function, and anemia, is considered to be a potential public health issue (Federation of American Societies for Experimental Biology 1995).<sup>32</sup>

In addition, the coefficients for vitamin C ( $P=.07$ ), vitamin A ( $P=.09$ ), and protein were positive but not statistically significant. These results occurred despite the small sample size, possible spillover effects, and a probable downward bias against WIC (due to the effect of rationing), all of which make finding positive statistical significance more difficult. The regression coefficient for energy was negative and insignificant, indicating that the increase in intake of these nutrients occurred as a result of increased nutrient density and not increases in the amount of food energy consumed.

Results of the univariate analysis, in which the mean nutrient intake of WIC children was compared with that of those who were ineligible to participate because their household income was too high, also support the finding of positive effects from participation in WIC. A relatively large percentage of children participating in WIC, in addition to being poor and at nutritional risk, came from single-headed households and households headed by persons with low education levels, characteristics that, one could argue, would make them especially vulnerable to low nutrient intake (see table 1).<sup>33</sup> In fact, one of the main premises of the WIC program is that the inadequate nutritional patterns and

health behavior of some low-income women and children make them especially vulnerable to adverse health outcomes. A review of the dietary, nutritional, and health-related status of the U.S. population completed in 1995 concluded that low-income people are less aware of the relationship between diet and health and are at greater risk of nutrition-related health problems (Federation of American Societies for Experimental Biology 1995). However, in this analysis, the mean intakes of iron, protein, and folate, for the low-income, nutritionally at-risk children who participated in WIC, were found to be significantly greater than those of WIC income-ineligible children (table 2). Intakes of the other WIC-targeted and potential WIC-targeted nutrients were also greater than those of the income-ineligible children, although not statistically significant. These results are consistent with a positive and significant effect of WIC on the nutrient intakes of children.

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<sup>31</sup>On the other hand, 98 percent of all children met the RDA for folate.

<sup>32</sup>The classification of nutrients as current or potential public health issues was based on intake levels among the population and evidence of adverse health consequences.

<sup>33</sup>Low education may result in the parent's being less aware of the adverse health outcomes resulting from poor nutrition and less able to plan nutritious meals. Single parents may have less time to plan and make more nutritious meals.